DECEMBER 15TH, 1900.

The Application of Storage Batteries to Railway Plants.

THE INSTALLATION

OF

TRADE MARK

"Chloride Accumulators"

REGISTERED SEPTEMBER 11, 1894.

FOR THE

PEEKSKILL LIGHTING & RAILROAD COMPANY,

PEEKSKILL, NEW YORK.

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BY

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"Storage Battery — Its Use on Small [illegible]

The application of storage batteries to the generating systems of large electric [illegible] described by many engineers in a variety of ways, so that an impression has been le[illegible] minds that it is only with these larger systems that the battery scheme is feasible. This idea [illegible] rect, and I think that the following description of the equipment and operation of the Peekskill Ligh[illegible] ing & Railroad Co. will bear me out in the statement. In the description of this road we shall see conditions that apply in a general way to most small lines.

This road was placed in operation in June, 1899, since which time it has been running without any interruption except momentary stops caused by the circuit breakers flying out. Beginning at the station of the New York Central R. R., which is at the western edge of the town near the Hudson River, the road proceeds in a practically straight line through the centre of the town and on to Lake Mohegan—total distance of four and three-quarter miles. The road is an exceptionally hilly one, as will be seen from an inspection of the profile of the road shown in Fig. 1. In fact the fairly level portions are the exception and are never more than 1,600 feet long. Beginning at the New York Central station terminus, the road, as far as grades are concerned, is about as follows: Starting into town, there is 1,000 feet of 7½ per cent. grade with a small portion (say about twenty feet) where it reaches nine per cent. For a distance of about 4,000 feet beyond this, there is a gradual grade varying from 5½ per cent. to two per cent., terminated by 300 feet of 5½ per cent. to 7½ per cent. At the top of this is a short level leading into a 2,000-foot two per cent. incline, followed by 1,600 feet varying from 4¼ per cent. to 8¾ per cent., which is in turn followed by 2,000 feet of 3¾ per cent. up grade. There is after this a depression represented by 1,400 feet of down grade, varying from 6 8-10 per cent to nothing, which, after passing into a short level, rises by 1,400 feet of up grade with a maximum of 4 6-10 per cent. to another short level. Then follows another down grade of about 1,800 feet, varying between eight and two per cent. This is followed by 1,600 feet of level, terminated by 300 feet of eight per cent. After this is 1,000 feet of level passing into a short down grade of six per cent.; 1,300 feet of level is after this, passing into 2,000 feet of 7½ per cent. The final portion to the end of the road is about 800 feet level.

This entire line is single track with four turnouts. Fifty-six-lb. T rails are used throughout, these being laid in the usual manner.

There is a single track branch 4,000 ft. long extending from the New York Central station north to the State Camp Ferry. This operates but one month of the year, at which time two cars are in service.

The overhead construction of the system is simple, consisting of 00 trolley throughout with a 0000 feeder extending to within one-half mile of the lake end and 1,000 ft. from the station end. The branch has no feeder. The 0000 feeder is tapped at regular distances throughout its length.

The apparatus for operating the road consists of one sixty-kw. Edison bipolar 575 volt, 880 r. p. m. generator belted to horizontal 13 x 12 Armington & Simms simple engine, the horse-power of which is about 100 at 275 r. p. m. Belted to this same engine, in tandem with the dynamo, is a four-pole differential booster, which is used to render the charging and discharging of the battery automatic.

There is another unit consisting of a Westinghouse 120-kw. multipolar 625 r. p. m. generator belted to a vertical 14 and 24 x 14 Westinghouse compound engine of 200 h. p. capacity. It may be added here that this generator is rarely used, and that only when the load is unusually heavy, such as occurs on holidays and warm Sunday afternoons. The same engine which operates this generator is also belted to one of the alternators for incandescent lighting. It may be well to note that in addition to the above engines, there are three other engines which operate the remaining lighting machines. These, of course, have nothing to do with the railway system. In the boiler room are three eighty-h. p. and one 100-h.p. H. R. T. boilers carrying steam at 105 lb. pressure. During the summer months, two of the eighty-h.p. boilers are sufficient to run the entire plant, though three become necessary in winter.

The battery, which is in a simple wooden shed next the boiler room, consists of 262 type F-9 "Chloride Accumulator" cells. Each cell is comprised of nine plates 10½ inches square, suspended in

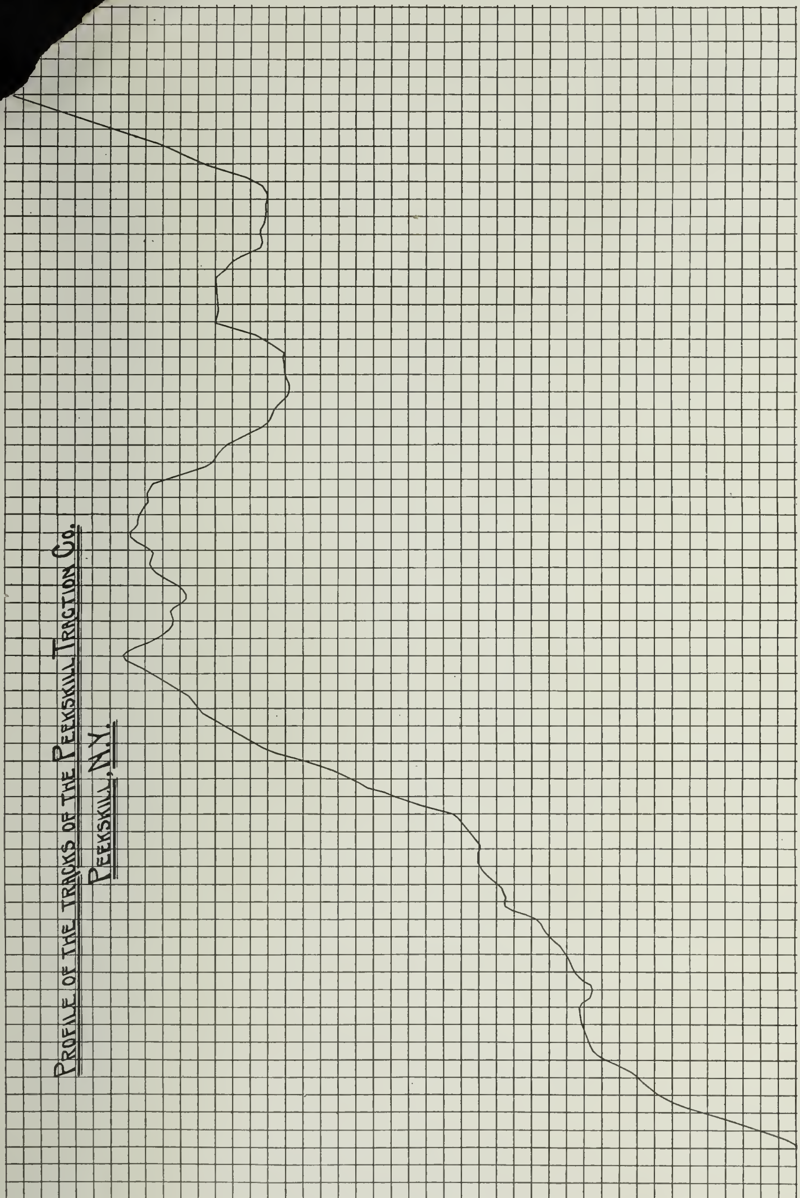
PROFILE OF THE TRACKS OF THE PEEKSKILL TRACTION CO.
PEEKSKILL, N.Y.

FIG. 1.

glass jars of sufficient size to enable the capacity to be increased in future by the addition of [illegible]. Each cell is mounted upon a wooden tray filled with sand to ensure an even foundation for [illegible]. These trays rest in turn upon glass insulators supported by a wooden battery rack. On full [illegible] the battery has a maximum rated capacity of 160 amperes for short periods. As a matter of [illegible] however, it is often called upon to discharge at a considerably higher rate than this, 250 amperes being called for momentarily.

During the summer season, three cars are run from 6 A. M. to 12 M. Two of these run through Peekskill as far as the car barn at the eastern edge of the town. The other car runs through the town and on to Lake Mohegan. This gives a twelve-minute schedule in town and forty-eight minutes through to the Lake. In the afternoon and evening four cars are run, giving a twelve-minute schedule in town, and twenty-four minutes through to the Lake. On holidays, etc., five cars are run, all going through, thus maintaining a twelve-minute schedule throughout the run.

From ammeter readings taken upon a six-ton open car, the following data were obtained—the readings being taken at points shown on the profile by red arrows. The red arrows also indicate the location of the cars at a given time on a five-car schedule, while the blue arrows show the position of cars on a four-car schedule.

Beginning at the left hand of the profile we have:

1st. 100 to 115 amperes.
2d. 25 amperes.
3d. 90 to 130 amperes.
4th. 80 amperes.
5th. 120 amperes.

Having gained a fair idea of the nature of the system, we will pass to the results obtained in the station.

The point of first importance is the remarkable constancy of the load upon the generator—and the correlated fact that the sixty-kw. machine is all that is necessary to operate the road except when running the five-car schedule. The curve marked No. 1 in Fig. 2 will explain this. This shows

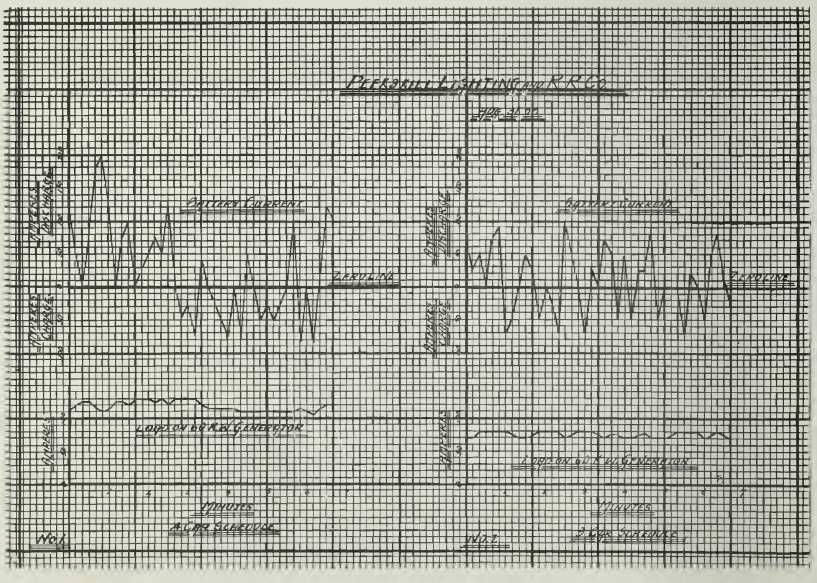

FIG. 2.

s of ten-second readings taken upon the battery and generator during a short portion of ar run. The total line current is, of course, the summation of these two. It is seen that otal current fluctuates between 25 and 310 amperes and that the generator runs along at ctically full and constant load, the battery assuming the fluctuations above and below this. Curve No. 2 shows the same results for a three-car run. Here the average or generator load is lower (about 75 amperes) and the line fluctuations from 0 to 170 amperes. The practical good of this is evident. It means that a sixty-kw. machine is running instead of 180 kw., which would be required were the battery not in service. In other words, although the load fluctuates from almost nothing to 180 kw., the average is in the neighborhood of sixty kw., and it is this average only which falls upon the generator and engine. The remarkable evenness of the load upon the generator produced by the operation of a storage battery is shown very nicely by the fact that we are operating our 120-kw. railway machine and one of the alternators for our electric lights from the same engine. Ordinarily this would produce a very serious flickering in the lights, but in our case it is impossible to detect the slightest change in the brilliancy of the lamps, although the railway load may be fluctuating between its widest limits. I have not had an opportunity to test the coal saving produced by this arrangement, but I am confident from my observations that it is sufficient to pay a good return upon the battery investment over and above the interest and depreciation charges. The increased economy of a small unit operating at a full and constant load above that of one three times the size, but doing the same work under highly fluctuating conditions, is such as to warrant this assumption.

It would be difficult to increase the simplicity of operation in this plant. After the original adjustment, the apparatus has worked together without the slightest difficulty. We have a generating unit operating under electric lighting conditions, due to the fact that the battery removes from the systems all sudden overloads, and the strain thus removed from the minds of those in charge is in its effect almost as valuable as this latter consideration.

In other ways the battery is valuable. A great many times it has been necessary to shut down the small engine suddenly from some mishap. During the eight or ten minutes necessary to get the other unit into operation, the battery has carried the entire load.

Then, too, it is often desirable to run a car for some special occasion very late at night. At such times the generator is shut down and the battery thrown across the line.

In conclusion I may state that the battery has given us absolutely no trouble since its installation, and the daily labor for its proper care does not average more than one-half hour. In fact, about all the work required is that of taking voltmeter and hydrometer readings upon the individual cells once each week.

The Electric Storage Battery Company invites correspondence, and upon request from the manager of an electric railway, will be glad to make an investigation and submit a report, showing the results to be obtained from the operation of "Chloride Accumulators" on his system.